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Selecting Soybean Varieties

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Selecting the right soybean variety is one of the most important management decisions a farmer will make. Although high yield potential typically is the most important criterion when selecting a soybean variety, minimizing risk also should receive consideration. Minimizing risk also means maximizing the chances of top yields if management is superior and Mother Nature cooperates. Selecting the right combination of high yielding genetics and agronomic traits is the first management decision toward a successful soybean crop.

Yield potential is genetically determined and varies among varieties; the known potential for maximum yield of soybean in the United States is 160 bushels per acre. Geographic location and environment are major influences that determine how much of the genetic yield potential is achieved at harvest. Iowa soybean yields top out at about 90 bushels per acre under ideal growing conditions.

A variety has a genetic makeup that responds to the environment in which it is grown and the management practices to which it is exposed. A variety that is chosen for having the highest yield potential under ideal conditions may not be yield competitive when yield-limiting factors such as disease and insects are present, unless the variety has the correct resistance profile.

Data combined across multiple relevant locations within a given year provide the most reliable yield estimates with which to select a variety.

Predicting year-to-year performance of a soybean variety is difficult because of our inability to accurately predict year-to-year variation in the weather.

New soybean varieties fresh from the breeding program may be more difficult to evaluate due to limited yield and other data. Often, the data behind these products are quite minimal. Don't wait until the company has a large dataset behind a product to make a decision, however. Minimize risk by planting a few acres of these varieties in two or more fields. It is best if a new variety is planted next to a proven variety of same maturity and similar agronomics in four or more alternating strips across the field.

When looking at data from replicated variety studies look for statistical values such as the least significant difference (LSD) and coefficient of

variation (CV). The LSD enables you to determine statistically valid differences between two comparisons within a study, or across studies. The lower the LSD the better the data which means the differences you see between the two comparisons are more likely to be true. Probability levels ranging from 0.05 to 0.20 are often associated with the LSD. LSD values associated with a probability level of 0.05 means you can be 95 percent confident that the differences you see between the means is true. A probability level of 0.20 means you can be 80 percent confident that the differences presented are real. The CV is a measure of the amount of variation within the trial; the lower the CV the less variation or "error" was present in the study. Ideally, the CV for each trial should be below 0.10, 10 percent, at a minimum. Studies with CV values less than 0.05, or 5 percent, are preferred.

For a more detailed description on interpreting data in yield trials go to www.extension.iastate.edu/CropNews/2010/0115rouse.htm

Iowa State University evaluates many soybean varieties for yield each year in the Iowa Soybean Performance Test. Annual performance test results and additional information are available at the Iowa Crop Improvement Association crop performance evaluation program website www.agron.iastate.edu/icia/

AGRONOMIC CONSIDERATIONS ARE IMPORTANT TOO

Specific disease and insect resistance or susceptibility of any given soybean variety can be as important for high, stable yields as genetic yield potential. Match the agronomics of all varieties, new or proven, to the known history of diseases within each field.

The most important agronomic trait to consider in Iowa is resistance to the soybean cyst nematode (SCN). SCN has been shown to reduce soybean yield by as much as 30 percent without causing visible above ground symptoms (6). Iowa State University plant pathologist Greg Tylka reported that 72 percent of the Iowa fields surveyed in 2007-2008 were infested with SCN (unpublished data). As of November 2008, this tiny roundworm had been found throughout Iowa, with the exception of Allamakee County.

To complicate matters, the presence of SCN can cause further stress to soybean also infected with brown stem rot or sudden death syndrome, resulting in additional yield loss (5,7).

There are many soybean varieties labeled as SCN resistant that have appropriate maturity for the length of growing season in Iowa. Many of these varieties are evaluated annually for yield and the ability to reduce SCN populations. Results of these trials and information on how to effectively improve management of SCN can be found at www.plantpath.iastate.edu/scn

Although SCN can greatly decrease yield of soybean, do not forget about other stressors such as sudden death syndrome, iron deficiency chlorosis, Phytophthora root and stem rot, and white mold. Single gene resistance to *Phytophthora sojae*, the causal agent of Phytophthora root and stem rot, is available in high yielding varieties suited to Iowa growing conditions. Look for varieties labeled as having R*ps*-a, R*ps*-c, R*ps*-1k, or R*ps*-6. Soybean varieties with R*ps*-1k are the most widely planted in Iowa. Some varieties with a relatively new gene, R*ps*-3c, and stacked R*ps*-1k/R*ps*-6 are available and should be used in fields where R*ps*-1k may be failing to provide adequate resistance (4). Diseases, like insects and nematodes, can and do overcome host plant resistance genes in

crop plants when enough selection pressure is applied to the pest.

Gene-specific resistance to sudden death syndrome, iron deficiency chlorosis, and white mold is not yet available. To manage these diseases, select varieties with strong agronomic scores that are based on field observations over a wide geographic area. Choose soybean varieties with above average agronomics but do not sacrifice yield potential because the presence or severity of these diseases cannot be accurately predicted.

MATURITY

Soybean is a short-day species that is adapted to narrow bands across large production areas of the United States. Flowering in short day plants is induced by a lengthening of the dark period, night. Zhang and coworkers (8) recently concluded that maturity groups 0-VI are best adapted to the United States soybean production system. Maturity group II soybeans are best suited to Iowa production but maturities ranging from late-group I through mid-group III can be grown.

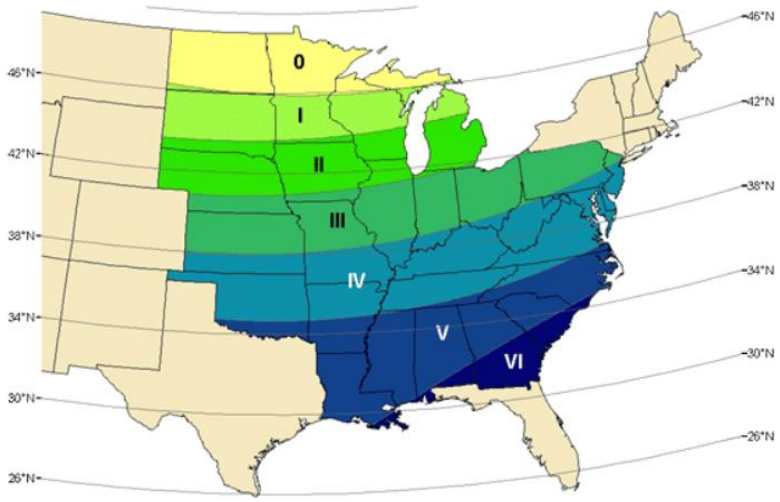

Figure 1. Soybean maturity groups of the United States as developed by Zhang and coworkers (8).

There is no standardized system for determining the maturity of a soybean variety. Therefore, it is difficult to compare the maturities of varieties among companies. Actual maturities may vary and are highly influenced by light, temperature, available water, and plant nutrition (1). Other stressors such as diseases, insects, and soil compaction can also hasten maturity of soybean.

Stress reduces the yield of soybean, especially if it occurs during the R1-R6 reproductive stages of growth as described by Fehr and Caviness (2). High yield soybean production systems begin with planting varieties with a range of maturities, spreading out physiological maturity over several days. This reduces the risk of crop failure due to short-term biotic and abiotic stress. Planting a variety south of its area of adaptation will result in the plant flowering and maturing much earlier than it would if it were planted within its primary area of adaptation. Planting a variety north of its area of adaptation will cause the plant to remain in a vegetative state much longer and delays flowering, increasing the chance of freeze damage prior to maturity.

INSECT RESISTANCE

McCarville and coworkers (3) reported that soybean aphid resistant varieties are an effective means of suppressing soybean aphids. Aphid-resistant varieties incorporate one or more genes conferring resistance to the soybean aphid. They report that these genes decrease aphid growth rate and reproduction but do not completely eliminate feeding. This causes aphid populations

to develop much slower than when feeding on susceptible plants, often preventing them from reaching economically damaging levels. Decreased population growth rate also allows natural enemies, various ladybird beetles, nabids, bigeyed bugs and other generalist predators, more time to adequately control aphids. Regular scouting is a good management practice even when an aphid-resistant variety has been planted. Chemical treatment of aphid-resistant soybeans may still be necessary when large aphid populations are present. Scouting guidelines and tips are available from ISU Extension and Outreach personnel at: www.ent.iastate.edu/dept/faculty/hodgson/extension

Soybean varieties with non-transgenic resistance to the soybean aphid are available for planting in Iowa. A listing of available aphid-resistant soybean varieties can be found at: www.ent.iastate.edu/soybeanaphid/files/Soybean aphid-resistant varieties 11 8 12.pdf

Additionally, some seed suppliers offer soybean varieties that suppress aphid growth that are not labeled as aphid resistant. Check with your local seed supplier to determine availability of these products.

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